

CLAIMS

What is claimed is:

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1. An apparatus comprising:
a substrate; and
a coating composition on a surface of the substrate comprising a plurality of deposited layers wherein at least one layer comprises a radiation-curable material.
2. The apparatus of claim 1, wherein the plurality of deposited layers comprises at least two layers and, relative to one another, a first layer has a high refractive index and a second layer has a low refractive index.
3. The apparatus of claim 2, wherein the second layer is formed on the first layer and the first layer has a thickness on the order of 50 to 150 nanometers and comprises a refractive index on the order of 1.45 to 1.75.
4. The apparatus of claim 2, wherein the second layer is formed on the first layer and the first layer comprises a crystalline metal compound.
5. The apparatus of claim 2, wherein the second layer is formed on the first layer and the second layer has a thickness on the order of 50 to 150 nanometers and comprises a refractive index of the top layer is 1.30 to 1.50.
6. The apparatus of claim 5, wherein the second layer comprises a silicon compound.
7. The apparatus of claim 6, wherein the second layer comprises a radiation-curable material.
8. The apparatus of claim 7, wherein the second layer comprises one of an ultraviolet and an electron beam-curable material.

9. The apparatus of claim 6, wherein the second layer comprises at least one acrylate monomer.

10. The apparatus of claim 9, wherein the acrylate monomer has an acrylic functionality of three or greater.

11. The apparatus of claim 9, wherein the second layer further comprises at least one of tetralkoxysilane, trialkoxysilane and dialkoxysilane having a fluoroalkyl group.

12. The apparatus of claim 1, wherein the coating composition comprises three layers, wherein, relative to one another, a first layer comprises a medium refractive index, a second layer comprises a high refractive index, and a third layer comprises a low refractive index.

13. The apparatus of claim 12, wherein the three layers are stacked one over the other, first layer to third layer, and the thickness of the first layer is about 50 to 150 nanometers and the refractive index of the first layer is about 1.45 to 1.55.

14. The apparatus of claim 13, wherein the first layer comprises a crystalline metal compound.

15. The apparatus of claim 13, wherein the thickness of the second layer is about 50 to 200 nanometers and the refractive index of the second layer is about 1.45 to 1.75.

16. The apparatus of claim 15, wherein the second layer comprises a crystalline metal compound.

17. The apparatus of claim 13, wherein the thickness of the third layer is 50 to 150 nanometers and the refractive index of the third layer is 1.30 to 1.50.

18. The apparatus of claim 17, wherein the third layer comprises at least one acrylate monomer.

19. The apparatus of claim 18, wherein the third layer comprises at least one (meth)acrylate monomer and a silicon compound.

20. The apparatus of claim 19, wherein the third layer has a property selected to be one of ultraviolet and electron beam-curable.

21. The apparatus of claim 17, wherein the third layer comprises:
at least one (meth)acrylate functional monomers having an acrylic functionality of three or greater;
an initiator; and
a polycondensed silicon compound of the mixture of tetraalkoxysilane and the trialkoxysilane or dialkoxysilane having a fluoroalkyl group.

22. A method comprising:
depositing a plurality of layers on a substrate, at least one of which comprises a radiation-curable material; and
curing at least one deposited layer by exposure to a radiation source.

23. The method of claim 22, wherein the plurality of layers comprises at least two layers, and relative to one another, a first layer has a high refractive index and a second layer has a low refractive index.

24. The method of claim 22, wherein the plurality of layers comprises at least three layers, and relative to one another, a first layer has a medium refractive index, a second layer has a high refractive index and a third layer has a low refractive index.

25. The method of claim 22, wherein the radiation source comprises an electron beam.

26. The method of claim 22, wherein the radiation source comprises ultraviolet light.

27. The method of claim 22, wherein depositing a plurality of layers on a substrate comprises one of a spinning process, a dipping process, and a rolling process.

28. The method of claim 22, wherein depositing a plurality of layers comprises depositing a radiation-curable layer of at least one acrylic monomer.

29. The method of claim 28, wherein the radiation-curable layer comprises at least one (meth)acrylate monomer and a silicon compound.

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